THE MAMMALS FROM SINGA AND ABU HUGAR

By Dorothea M. A. Bate

Introduction

Knowledge of the earlier mammalian faunas of the Anglo-Egyptian Sudan has been meagre until now, and the few published records may be briefly noticed here. In 1876 Vacek described a skull of a fossil buffalo which was found associated with remains of a large hippopotamus, and was said to have come from a fluviatile deposit at no great distance from Khartoum. The author considered that it represented an animal belonging to the *antiquus* group, with horns very different from those of *Syncerus caffer*, and growing directly outwards and backwards. He suggested that it belonged to a distinct species, but refrained from supplying a name; there can be little doubt that this was a skull of the extinct buffalo to be described below.

Little more than ten years later Lydekker (1887) described some mammal remains from Wadi Halfa which he suggested were of early Pleistocene or uppermost Pliocene (Villafranchian) age. The most important specimen is an upper cheek tooth of an *Equus* belonging to an earlier type than those of the present day. This tooth has sometimes been quoted as showing the presence of *E. sivalensis* in Africa, but Lydekker himself acknowledged that this single example was insufficient for specific determination. The study of the fossil Equidae of Africa is at present in rather a bewildering condition, but it is hoped that Professor Arambourg may soon give us a comprehensive view of the whole subject. Some remains of *Cervus* were mentioned in connection with Lydekker's Wadi Halfa collection, but I can find no further details or description. Remains of *Cervus* have also been recorded in a Villafranchian fauna from Gau by Parona (1918, p. 828). With other Asiatic genera such as *Sivachoerus*, *Cervus* seems to have reached Africa at this time, but so far as is known at present failed to establish itself. The Recent North African deer are probably a later introduction.

Many years after this Andrews (1912) described an imperfect tooth of an elephant which had been found at a depth of 60–68 feet below the low level of the Nile not far from Khartoum. It is not certain to what extinct species it should be referred, and the geological age of the deposit is equally uncertain. The associated fauna included remains of hippopotamus, a small giraffe, an antelope (?*Tragelaphus*), and a siluroid fish.

In 1927 a small collection of mammal remains was secured by Mr. A. J. Arkell during the digging of a well in his garden at Kosti on the White Nile, about 180 miles south of Khartoum. Among these were the canine of a carnivore, and the third lower molar of a large extinct pig which Dr. A. T. Hopwood (1929) described under the name of *Hylochoerus grabhami*, but which Professor Arambourg has since suggested (1944 and 1947) should be included in the extinct genus *Omochoerus*.

More recently, as a result of Mr. A. J. Arkell's excavation of an early occupation site (Mesolithic) in Khartoum itself (1949) a large collection of animal remains was available for study. The specimens were much broken, but showed the presence of a fauna very different from that occurring in this area at the present day. The only animal that could be determined specifically proved to be an extinct species, *Thryonomys arkelli*, with affiliations with a group of Reed Rats, members of which have been found fossil in the central and western Sahara (Bate, 1947 and 1949).

The collection now to be described marks an important advance in our knowledge of the early zoological history of the country, and is indeed of more than local importance, since the study of one of the specimens has revealed facts of considerable significance for African mammalian palaeontology. The remains were sent to the British Museum (Natural History) for study in 1947 by Mr. A. J. Arkell, then Commissioner for Archaeology and Anthropology in the Sudan. They were obtained from the bed, or from the base of the bank, of the Blue Nile at two localities, Singa and Abu Hugar, south of Khartoum. Being well acquainted with the two sites Mr. Arkell considers that they are undoubtedly of the same geological age, and this is supported by the specimens themselves. An extinct species is known from each site, and remains of the extinct buffalo occur at both localities. This makes it possible to treat the remains from the two sites as comprising a single fauna.

Singa, 200 miles south of Khartoum, has long been known as the site from which Mr. W. R. G. Bond, in 1924, obtained the human skull which was later described and figured by Smith Woodward (1938). More recently Dr. L. H. Wells of the University of Witwatersrand has re-examined the skull with a view to comparing it with later finds from South Africa, and his results are given in one of the sections of this report. In a note following Smith Woodward's paper Mr. G. W. Grabham published a figure of a section of the site which certainly suggests a considerable age for the contained remains. Behind the foreshore, then the low river level of the Blue Nile, rose an almost vertical bank about 30 feet high and having a sequence of five distinct levels. Mr. Grabham suggested that the animal remains came from the older river deposits, level 4 in his table, with the reservation that they might be of even greater age.

The site of Abu Hugar is about 25 miles further up the river; here bones may still be found weathering out of the river bank, and it was under these conditions that the crocodile skull was obtained. An important factor at this site is the occurrence, associated with the animal remains, of implements of a crude human industry containing Levalloisian elements. These have been studied by Mr. A. D. Lacaille, and are described in another section of this report. Dr. J. D. Tothill (1946) has published an interesting study of the Gezira Clay Plain which lies south of Khartoum between the Blue and the White Nile. He deals chiefly with the fossil molluscan fauna and gives a provisional table of contemporary events based on this study. In this he correlates the Singa deposit with the Lower Levalloiso-Mousterian Levels C. & D. of Tabun Cave, Palestine. Further information about the formation and derivation of the Gezira Clay which is later than the mammal deposit is awaited from Mr. G. Andrew, Government Geologist, who is making a petrological study of its component elements.

All the specimens in the collection are more or less completely covered with a concretion of kankar. Most of the bones are broken, and too imperfect to admit of

definite specific determination, except in the case of two skulls, one of a buffalo and the other of a porcupine, each of which represents an extinct form. With two exceptions the animal remains are those of mammals, mostly ungulates. The two exceptions are a river shell kindly examined by Dr. L. R. Cox, and a portion of a skull of a crocodile, which Dr. W. E. Swinton has kindly identified, his report being given below. Remains of ten species have been determined and are as follows:

1. Freshwater Snail.	
2. *Crocodilus niloticus* Laurenti	Nile Crocodile.
3. *Hystrix astasobae* sp. n.	Extinct Porcupine.
4. *Equus* sp.	Equine.
5. *Rhinoceros* sp. (large)	Rhinoceros.
6. *Hippopotamus* cf. *amphibius* Linnaeus	Hippopotamus.
7. ?Sivatherine	?Short-legged Giraffoid.
8. *Oryx* sp.	Oryx.
9. ?Antilopine or ?Caprine	Extinct Antilopine.
10. *Gazella* sp.	Gazelle.
11. *Antilope* sp. (?Hippotragine)	Antelope (large).
12. *Antilope* sp. (about size of Grant's gazelle)	Antelope.
13. *Homoioceras singae* Bate	Extinct long-horned Buffalo.

Description of Species

Freshwater Snail

The single shell in the collection is in a very imperfect state of preservation. Dr. L. R. Cox writes: "It seems to be a sinistral freshwater snail."

Crocodilus niloticus Laurenti

Dr. W. E. Swinton writes of the single imperfect skull of a crocodile: "There is a considerable variation in the size and disposition of the teeth, in the shape of the premaxillary-maxillary suture, and in the size and shape of the openings of the premaxillary region of the Nile Crocodiles. I have gone through the Museum series of complete skulls and this fragment from Abu Hugar can be matched very closely. There is no question as to its being *Crocodilus niloticus* and it therefore throws little light on the precise age of these deposits. The fragment, the premaxilla with teeth, is fossilized and probably late Pleistocene."

C. niloticus is recorded as one of two species found in the Omo River beds (Arambourg, 1947).

*Hystrix astasobae** sp. n. (fig. 1)

Diagnosis.—A *Hystrix* about the size of *H. cristata,* with similar inflation of roof of skull. Rostrum short, shorter than in Recent species, and stout, anterior portion not narrowly constricted as in Recent species. Upper anterior border of premaxilla

* From Astasobas, an ancient name for the Blue Nile used by Strabo.

prominent, not deeply excavated as in Recent species. Nasals scarcely narrowing anteriorly, of similar width for almost their entire length with posterior border wide as in *H. africaeaustralis*. Nasals long, extending backwards to about the level of the glenoid fossa as in *H. cristata*. Upper posterior process of premaxilla narrow. Upper cheek teeth large compared with skull, as in *H. africaeaustralis*; posterior processes of palatines, and pterygoids stout, stouter than in Recent species. Palate reaching back to level with the anterior border of the last molar.

FIG. 1. Holotype skull of *Hystrix astasobae* sp. n.: (a) lateral view; (b) palatal view, natural size.

HOLOTYPE.—The anterior portion of a skull with two cheek teeth (fig. 1).

LOCALITY AND HORIZON.—Abu Hugar, about 25 miles up river from Singa on the Blue Nile, at the base of the river bank. Pleistocene, associated with a human industry, remains of *Homoioceras singae*, and other mammals.

DESCRIPTION AND REMARKS.—The single imperfect skull from Abu Hugar probably represents the first extinct species of porcupine to be recorded from Africa. Probably through pressure during fossilization the skull is slightly distorted, chiefly

in being somewhat compressed laterally, but it is still possible to observe many important characters, though precise measurements are not always obtainable, and the specimen itself is difficult to display adequately by means of drawings. When collected this skull, like that of *Homoioceras singae,* was almost completely covered with a concretion of kankar.

The Recent African porcupines can be divided into two groups (Ellerman, 1940). The *H. cristata* group, which is distributed over the northern and central part of the Continent, and the *H. africaeaustralis* group, which is found in suitable country in south and south-eastern Africa and at least as far north as Tanganyika territory. The skull of *H. astasobae* is more primitive in several respects than are skulls of Recent species, and it also shows some characters similar to those found in each of the two groups just mentioned. This is of course in keeping with its rather more generalized condition.

Great variation is seen in many of the bones of the skull in both the Recent groups, and perhaps one of the most constant characters is the comparative length of the nasals; in the *H. africaeaustralis* group these bones extend posteriorly only as far as in line with the anterior border of the orbit, whereas in the *H. cristata* group they reach as far back as in line with the posterior border of the orbit.

In *H. astasobae* the length of the nasals is about 74 mm., much as in *H. cristata,* but the short palate resembles the condition seen in *H. africaeaustralis.* Viewed dorsally the nasals in *H. astasobae* remain of almost constant width throughout their length, as in *H. cristata,* while the wide outline of their hinder borders resembles that seen in *H. africaeaustralis.*

One of the more noticeable of the primitive characters of the fossil skull is the short thick snout, which, viewed ventrally, does not exhibit that sudden contraction in the vicinity of the anterior palatine foramina which is so characteristic of Recent species. Another remarkable difference in this area is that, viewed longitudinally, the anterior portion of the upper border of the premaxilla in Recent species is deeply excavated above the incisor, while in *H. astasobae* the bone slopes gradually from its contact with the nasal. Viewed ventrally the skull of *H. astasobae* shows that the posterior processes of the palatines with the pterygoids are of unusual thickness.

Fossil Record.—Fragmentary remains of porcupines have been recorded from a great number of Pleistocene deposits in Africa, from Morocco, across north Africa and southwards almost to the Cape, but none seems to have been sufficiently well preserved for definite specific determination.

A tooth which may eventually be found to represent a near ally, if not a true *Hystrix,* was described and figured by Wells, Cooke & Malan a few years ago (1942). This specimen came from the Vlakkraal Thermal Springs, Orange Free State, and it has been suggested that the age is Upper Middle Stone Age, i.e. Upper Pleistocene.

Equus sp.

The collection includes three imperfect upper cheek teeth of an equine from Abu Hugar, but these are not sufficient to determine to which group they should be assigned, the zebras or the wild asses.

At the present day, zebras are found in the south-eastern corner of the Sudan in the Upper Nile and Equatoria Provinces. Wild asses occur in the opposite end of the country in the north-east, being recorded from the Red Sea Province, and from the vicinity of the Atbara River in the Provinces of Berber and Kassala (Brocklehurst, 1931).

The fossil record is meagre; the finding of equine remains at Wadi Halfa has already been referred to, and a single upper cheek tooth specifically unidentified was found in a Mesolithic site at Khartoum (Bate, 1949, p. 24).

Rhinoceros sp.

A rhinoceros is represented by an imperfect upper cheek tooth from Abu Hugar and the proximal portion of a right femur from Singa, neither of which show characters that are sufficient for definite specific identification. The femur, however, is of large size, with a maximum width of 23 cm. across the head and great trochanter, thus equalling the corresponding measurement of this bone in a Recent specimen of *R. simus* with which it has been compared. This suggests that it may be that of *R. simus*, the white rhinoceros, but the presence of a number of extinct species in the collection makes it unwise to affirm the occurrence of Recent species without ample material on which to base the identification.

Remains of rhinoceros were obtained from the Mesolithic Khartoum site (Bate, 1949) but are thought to have belonged to a smaller species than the above.

Hippopotamus cf. *amphibius* Linnaeus

Teeth and portions of limb bones of hippopotamus are more plentiful than those of any other species, and both adult and quite young individuals are represented. The specimens, which were found at both the Singa and Abu Hugar sites, are too fragmentary for a definite specific identification to be made.

?Sivatherine (fig. 2)

There are two imperfect limb bones from Abu Hugar which, although too fragmentary for definite identification, are of great interest since they suggest the presence of an extinct genus. These two bones are the distal portion of a right radius shown in fig. 2 and the distal end of a left humerus, which are certainly giraffoid in character. Compared with the corresponding bones in Recent and Pleistocene giraffes they show evident differences, the most important of which is the great width of the shaft as compared with the width of the distal articular end of the bone. The humerus of a large Recent giraffe and the specimen from Abu Hugar each have a maximum condylar width of 13 cm., while the width of the shaft a short distance above the condyles is 13·7 cm. in the Recent and 15·2 in the fossil specimen. The fossil radius at its distal articular end has a width of approximately 14 cm., while the width of the shaft is 10·5 cm. The corresponding measurements in that of a large Recent giraffe are 13·5 cm. and 8·7 cm.

While much more material is required before a definite identification can be made, the character of these two bones suggests that they belong to an extinct genus allied

to *Sivatherium*. This would not be surprising, for remains of Sivatherines of various genera have already been discovered in north, east and south Africa. Some of the deposits from which these specimens come are not definitely dated, but it seems certain that they include localities of both early and Middle Pleistocene age.

Professor Arambourg has recently (1947 and 1948) written fully on the African Sivatherines, so it will suffice here to mention only the chief records and localities. Pomel (1892 and 1893) was the first to recognize the existence of the group in Africa when he described *Libytherium* from Algeria. This, or an allied form, has also been recorded from the early Pleistocene of the Wadi Natrun (Stromer, 1907). *Sivatherium olduvaiensis* Hopwood (1934) was first described from Olduvai, and has since been found in the southern Serengeti (Dietrich, 1942, pl. 19), and in the Omo River basin in Abyssinia (Arambourg, 1947, pl. 22). In South Africa the Vaal River gravels have yielded some teeth known as *Griquatherium cingulatum* Haughton (1922), and this species has since been discovered in the Makapan Valley, Transvaal (Cooke & Wells, 1947).

$\frac{1}{2}$

FIG. 2. Distal end of a right radius of a ?Sivatherine, $\times\frac{1}{2}$.

Oryx sp.

There is a piece of horn core from Abu Hugar, 16·5 cm. in length, which unmistakably represents an oryx, though unfortunately it is not sufficient to indicate to what species it should be assigned.

Two species of oryx can be counted among the Recent fauna of the Sudan, though neither is at present found in the vicinity of Singa. *Oryx beisa* is found to the north-east in the southern part of the Red Sea Province, and also in the east of Mongalla (now Equatoria) Province in the south. The white oryx, with curved horns, which has been placed in a separate genus, *Aegoryx*, occurs in the extreme north of Darfur and Kordofan, and perhaps in the Northern Province, its range extending westwards to Nigeria and the Gold Coast (Brocklehurst, 1931).

At the present day oryxes are generally found in more or less desert country, but this does not seem a natural habitat for large bovines, and has probably been adopted through pressure of necessity.

Antilopine or ?Caprine (fig. 3)

The collection includes a complete right horn core with a portion of the frontal and the eye socket preserved, from Abu Hugar. It was thought to represent one of the larger African antelopes, but comparison with the horn cores of representatives of almost every group of Recent African antelope, and with ibex, *Ammotragus*, and also various Asiatic forms has failed to reveal any of comparable shape. Specimens and figures of fossil species have likewise been consulted, with a similar result. There can, therefore, seemingly be little doubt that the horn core from Abu Hugar represents a species, if not a genus, hitherto undescribed. It seems unwise to give a name to this single specimen, but the drawings will serve to put it on record, and perhaps help in diagnosing future finds.

It will probably be found eventually that this horn core belonged to an antelope of large size, but the presence of a rounded keel on its anterior surface suggests the necessity for caution since a frontal keel seems to be unknown among Recent African antelopes, though it is not uncommonly present in some earlier Asiatic fossil forms (Teilhard & Trassaert, 1938 (?*Protoryx*); Pilgrim, 1937). The shape of this horn core might possibly suggest Caprine affinities, though this does not seem very likely.

It will be seen from fig. 3a that the horn core rises straight upwards directly above the orbit, and later curves gradually backwards. Viewed from in front (fig. 3c) it slopes outwards, and shows a slight tendency towards a spiral turn. The inner basal margin is fairly close to the frontal suture, showing that the bases of the two horns must have been close together. The maximum length of the horn core preserved is about 110 mm. measured in a straight line; the diameter from side to side at the base is 27 mm., and from front to back 46 mm. The specimen is narrow anteriorly with rounded keel, widening to the back; it is laterally compressed, with the inner surface slightly rounded, and the outer one practically flat. The entire surface is longitudinally grooved, in places to some depth.

Gazella sp.

Two fragmentary cheek teeth from Abu Hugar indicate the presence of a fairly small gazelle, perhaps about the size of *G. dorcas*.

Antilope sp.

A single horn core of a large antelope from Singa probably represents one of the Hippotragine group.

Antilope sp.

A right maxilla with three cheek teeth of an antelope is among the specimens from Abu Hugar. It is not possible to identify it specifically, but it resembles in size the corresponding portion of the skull in a Recent example of a female Grant's gazelle.

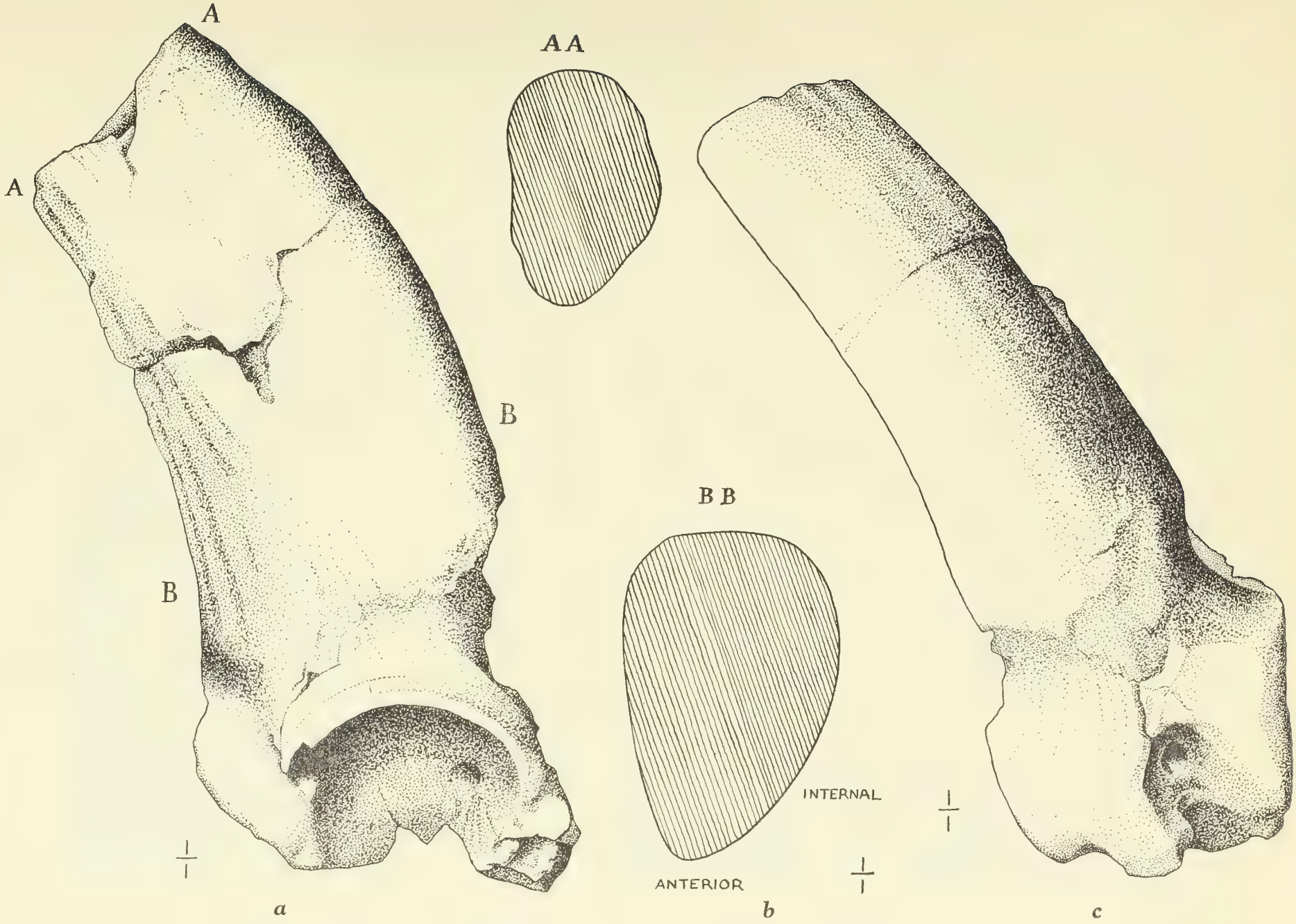

FIG. 3. Horn core of ?Antilopine: (a) lateral view; (b) sections; (c) anterior view, natural size.

Genus *HOMOIOCERAS* Bate

1949*a* Ann. Mag. Nat. Hist. (12) **2**: 397

The study of the buffalo remains from Singa has greatly helped to clarify the systematic position and the relationships of the long-horned fossil buffaloes of Africa. As will be shown below, they manifestly belong to the generic group Syncerina of the subfamily Bovinae (Pilgrim, 1939, p. 23), but as evidently represent a lineage distinct from the Recent African *Syncerus*, and one that is not ancestral to the Recent forms. I have, therefore, proposed (1949*a*) that the extinct long-horned African buffaloes be known as *Homoioceras*.

Diagnosis.—Extinct buffaloes belonging to the African Syncerina group. Generally of large size with very long and wide-spread horns, having a superficial resemblance to those of Recent *Bubalus*. Keels of horns obsolete except the hinder one. Males generally with horns nearly meeting on forehead, but without basal expansion; bony forehead rugose, but without raised prominences supporting the basal portions of the horns. Bases of horn cores project at right angles to the skull, and may be inclined slightly downwards. Face very, or moderately, short, rather or very broad; eye sockets not tubular. Only a short connection between the nasals and the nasal processes of the premaxillae. Palate short, and having no contact with the vomer; basi-occipital rising at an acute angle, or on a gradual slope; basi-sphenoid rising on a gentle slope. Basi-occipital a long isosceles triangle in shape.

Type Species.—*Homoioceras singae* Bate.

The species at present known and here included in the genus are:

Bubalus antiquus Duvernoy, 1851	North Africa
Homoioceras singae Bate, 1949*a*	Anglo-Egyptian Sudan
Bubalus nilssoni Lönnberg, 1933	East Africa
B. baini Seeley, 1891	South Africa

Homoioceras singae Bate (figs. 4, 6, 8a)

Diagnosis.—A *Homoioceras* slightly smaller than *H. antiquus* and *H. nilssoni*, but skull massive, with bones noticeably thick. Face short and broad, forehead slopes gently down to the nasals as in Recent *Syncerus brachyceros* from the Lake Chad area. Nasals vaulted, short and wide, with short area of contact with the posterior processes of the premaxillae. Supraorbital pits large, orbits slightly prominent. Horn cores arising only a short distance above the orbits, growing out horizontally with the dorsal surfaces in line with the top of the skull, no immediate downward inclination, frontal keels rudimentary, posterior keel present, section roughly elliptical. Occipital area of skull of great width, bases of para-occipital processes notably stout.

Basi-occipital bent upwards at an acute angle, with the basi-sphenoid continuing to rise gently. Basilar tubercles small, the bullae projecting well below the level of the basilar tubercles, and more inflated than in Recent *Syncerus*. The slightly concave palate is wide and short and has no contact with the vomer which arises a considerable distance beyond the basilar tubercles.

Holotype.—An almost complete skull from Singa, with the upper dentition and the bases of the horn cores, the left one preserved for a length of 105 mm.

Other Specimens.—Besides the skull from Singa a number of fragmentary specimens were obtained at Abu Hugar. One, part of a maxilla with cheek teeth, resembles very closely the corresponding part in the holotype. There are two pieces of horn core evidently from near the distal end of the core, the largest has a length of 46 cm., is deeply scored longitudinally and is strongly compressed laterally. The smaller piece has a circumference of 20 cm.

Distribution.—At present known from the Nile Valley, Anglo-Egyptian Sudan.

Description.—The most interesting specimen in the collection is the beautiful and unusually well-preserved skull of *H. singae* described above, for the discovery of which much credit is due to Sadik Eff. Nur of the Khartoum Museum. He recovered it from a government office at Singa where for more than ten years it had been performing the menial function of a door-stop. It is almost unbroken except for the loss of the greater part of the horn cores, and the anterior ends of the nasals and premaxillae. This completeness is partly due to its having become highly mineralized, and to its being protected by a thick coating of limy concretionary matter (kankar). This protective covering has since been almost entirely removed with great skill and care by Mr. A. E. Rixon.

There is a slight distortion of the skull due to pressure during fossilization, but fortunately this has had little effect on the general form of the specimen, except perhaps with regard to the position of the nasals which have been forced downwards. This makes it difficult to be quite sure of the original position of the outer borders of these bones, but it is almost certain that they were in contact with the premaxillae for a short distance, perhaps for 10 mm. Such a short junction of these bones is commonly found in some members of this genus and in *Syncerus*.

Comparing the skull of *H. singae* with that of a Recent buffalo from Sennar in the Sudan it is found that, although the general size is not very different, the massive proportions of the bones, and the great breadth and depth of the fossil skull are remarkable. Although they resemble each other in essential characters, one of the features in which the fossil displays a more primitive condition is the degree of difference between the upper and lower portions of the face. In the Recent species the facial portion of the skull is distinctly weak and attenuated, while the fossil displays stouter proportions.

This will perhaps be best appreciated by the measurements given in millimetres in the table below; the length of the skull of *H. singae* is approximate, owing to the absence of the anterior portion of the premaxillae.

Viewed in profile (fig. 8a) it is seen that in the skull of *H. singae* the forehead slopes gently down to the nasals, as it does in the Recent *S. brachyceros* from Lake Chad, but in the skull from Sennar, and still more so in typical skulls of *S. caffer*, the forehead

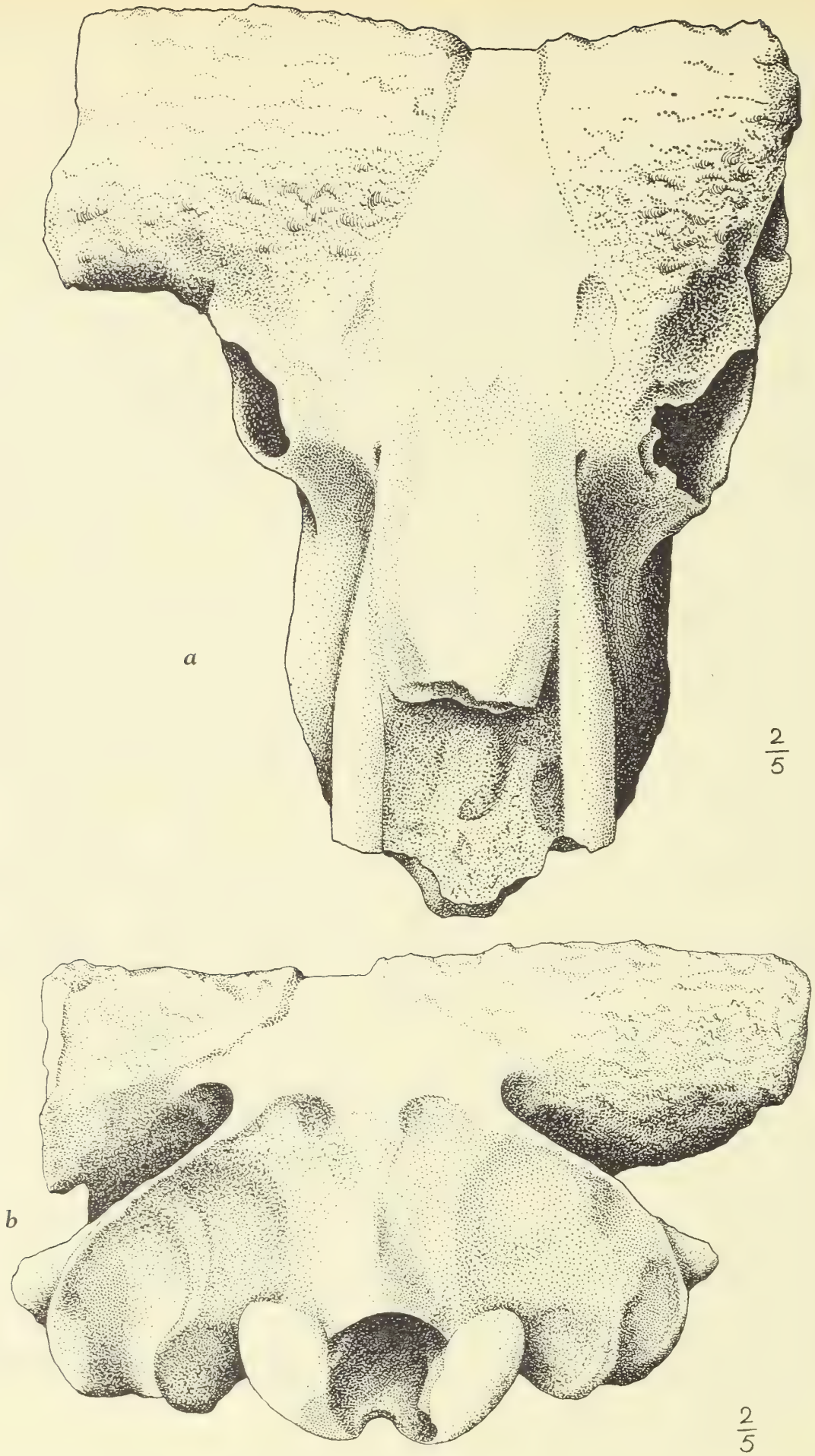

FIG. 4. *Homoioceras singae* Bate: (a) anterior; and (b) posterior views of skull (holotype), $\times\frac{2}{5}$.

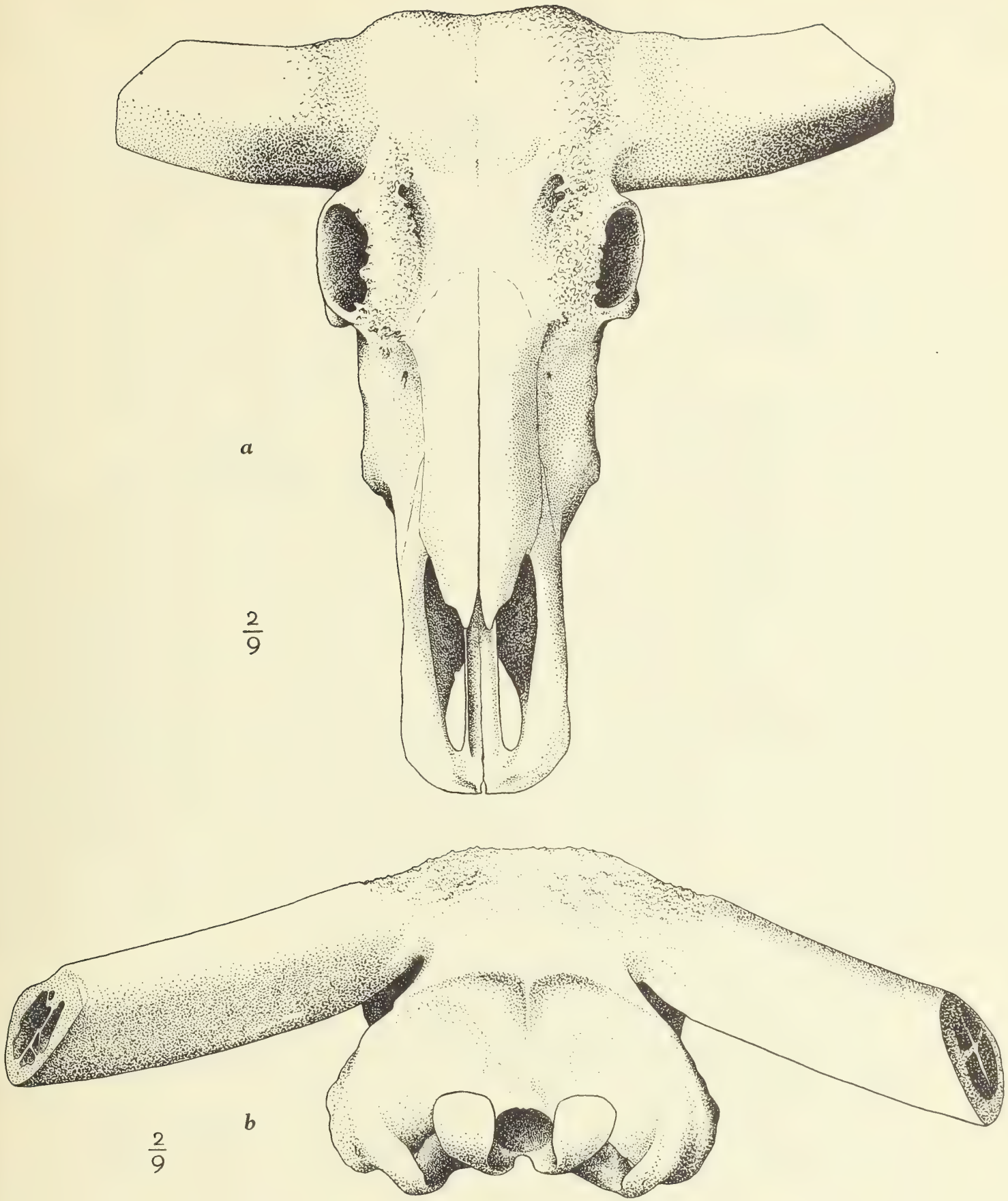

FIG. 5. *Bubalus bubalis* (Linn.). Recent skull from India: (a) anterior; and (b) posterior view, $\times\frac{2}{9}$.

	H. singae	*H. antiquus* (Pomel's specimen)	*H. nilssoni*	Recent *Syncerus* (Sennar)	Recent *Bubalus*
Length of skull from tips of premaxillae to the occipital condyles	510	600	650	512	610
Breadth of skull in front of orbits	170	225	204	150	173
		H. antiquus type			
Maximum width of occipital area	315	360	—	245	290
Maximum width of M^2	34	38	29	27	32
Upper alveolar length	151	170	156	145	175

drops abruptly to the lower facial region, resulting in what might almost be described as an interorbital cavity.

There can be little doubt that the Singa skull is that of a bull, this being shown not only by the massiveness of the skull, but also by the fact that the forehead between the roots of the horn cores is covered with a slight bony rugosity except for a median area about 35–40 mm. in width. In the skulls of Recent species of *Syncerus* the rugosity of this region is for the attachment of the overlap of the dorsal part of the horn sheath, and no doubt a similar explanation is applicable to fossil skulls. In some skulls of *S. caffer*, which is a highly specialized form, the wide proximal expansions of the horn sheaths are further supported by bony prominences of the skull. In female skulls of Recent *S. caffer*, not only are the horns very much smaller than in the male and without the proximal expansion, but there is only a slight roughness on the forehead of the skull.

In the holotype skull of *H. singae* the anterior ends of the nasals are missing, but judging from other proportions it seems probable that they had a maximum length of about 195 mm. The corresponding measurement in a Recent Asiatic *Bubalus* skull is 265 mm. In *H. singae* the nasals are vaulted, and very broad, having a width of 52 mm. at their junction with the premaxillae; this measurement in the Recent *Syncerus* skull from Sennar is only 39 mm. The great thickness of the bones of the skull of *H. singae* can be easily appreciated from the view of the front of the face (fig. 4a) in which can be seen the upper borders of the premaxillae; these have a thickness of 24 mm., compared with 13 mm., in the Recent Sennar skull. In a Recent *Bubalus* skull, a larger animal than *H. singae*, this measurement is 19 mm.

It will be seen from fig. 4a and fig. 4b that the horn cores of *H. singae* emerge almost horizontally from the skull, and continue thus for at least 105 mm., the length preserved of the right core.

A somewhat similar condition can be observed in the holotype of *H. antiquus* from Setif although the section of the horn cores is very different from that seen in *H. singae* (fig. 8a, 8c).

From their section, size and direction it may be supposed that *H. singae* carried comparatively narrow but long horns, generally similar to those of the *H. antiquus* group, but, with the exception of the holotype mentioned above, in *H. antiquus* as

shown in Pomel's and other figures, in *H. nilssoni*, and in *H. baini* the horns have a downward slope from their inception. In Recent *Bubalus* (figs. 5, 7, and 9a), except for the straight-horned variety (*B. macroceros*) from Assam, while the horns likewise make an immediate downward sweep, the direction is quite distinct from that in *Homoioceras*. Among Recent African buffaloes the horns are totally different from those of the *H. antiquus* group in which *H. singae* is included; many of the *S. nanus* group have uprising horns, while the large group culminating in *S. caffer* have horns broad at the base, sharply down-bent and then upturned at the narrow tip.

There is a strong superficial resemblance between the horns of Recent *Bubalus* and of the fossils *H. antiquus*, *H. singae*, *H. nilssoni* and *H. baini*, but this is certainly the result of parallel development, reached by independent lineages. Nevertheless it is no doubt this superficial likeness that has misled so many authorities to include the fossil African buffaloes in the Asiatic genus *Bubalus*.

Turning to the under-side of the skull of *H. singae* (fig. 6) we find some of the most important and primitive characters displayed. The shape of the basi-occipital is as in Recent *Syncerus* and in *H. antiquus*, that is to say that from the basilar tubercles the bone narrows rapidly to a point. The basi-occipital is bent upwards at an acute angle, and the basi-sphenoid then continues to rise at a gentle slope. A similar condition is seen in the specialized forms of Recent *Syncerus*, but in the more primitive *S. nanus*, with small upright horns, the basi-occipital, as well as the basi-sphenoid, rises at a gentle angle. It was thought at first that the angle of the basi-occipital might be governed by the weight of horn to be carried, but the angle is similar in the small-horned Recent *S. nanus* and in the holotype skull of *H. antiquus* with its unusually massive horns. It is probable that the angle is governed by the position in which the head is carried, while that again would be influenced by feeding habits. In Recent *Bubalus* the under-part of the skull is completely different (fig. 7). The basilar tubercles differ in size and construction, and the shape of the basi-occipital is almost quadrate, the bone being distally truncated; further it receives the proximal end of the vomer between the basilar tubercles, whereas in the Syncerina the vomer originates considerably in advance of this point. The basi-occipital in *Bubalus* rises at a gentle slope as far as the basilar tubercles, but in front of this the basi-sphenoid rises suddenly at a steep angle.

In *H. singae* the bullae are more inflated, and the hyoid pits are actually and comparatively larger than in Recent *Syncerus*.

In the *Homoioceras singae* group (fig. 6), as in Recent *Syncerus*, the vomer has no contact with the palatines, and the short palate hardly reaches behind the tooth row. The palate is broad and slightly concave, the width between the bases of M^3 is 90 mm. In Recent *Bubalus* again there is seen a great contrast (fig. 7), for the palate is narrow and prolonged considerably behind the tooth rows, and where the palatine processes and the pterygoids meet is an expanded area. The vomer is fused with, and partly enclosed by, the hinder edges of the palatines, and at this point of contact the vomer becomes considerably thickened. Pilgrim (1939: 255) has pointed out that this is the condition already seen in *Proamphibos* and *Hemibos* (Middle and Upper Pliocene), the earliest known members of the *Bubalus* lineage.

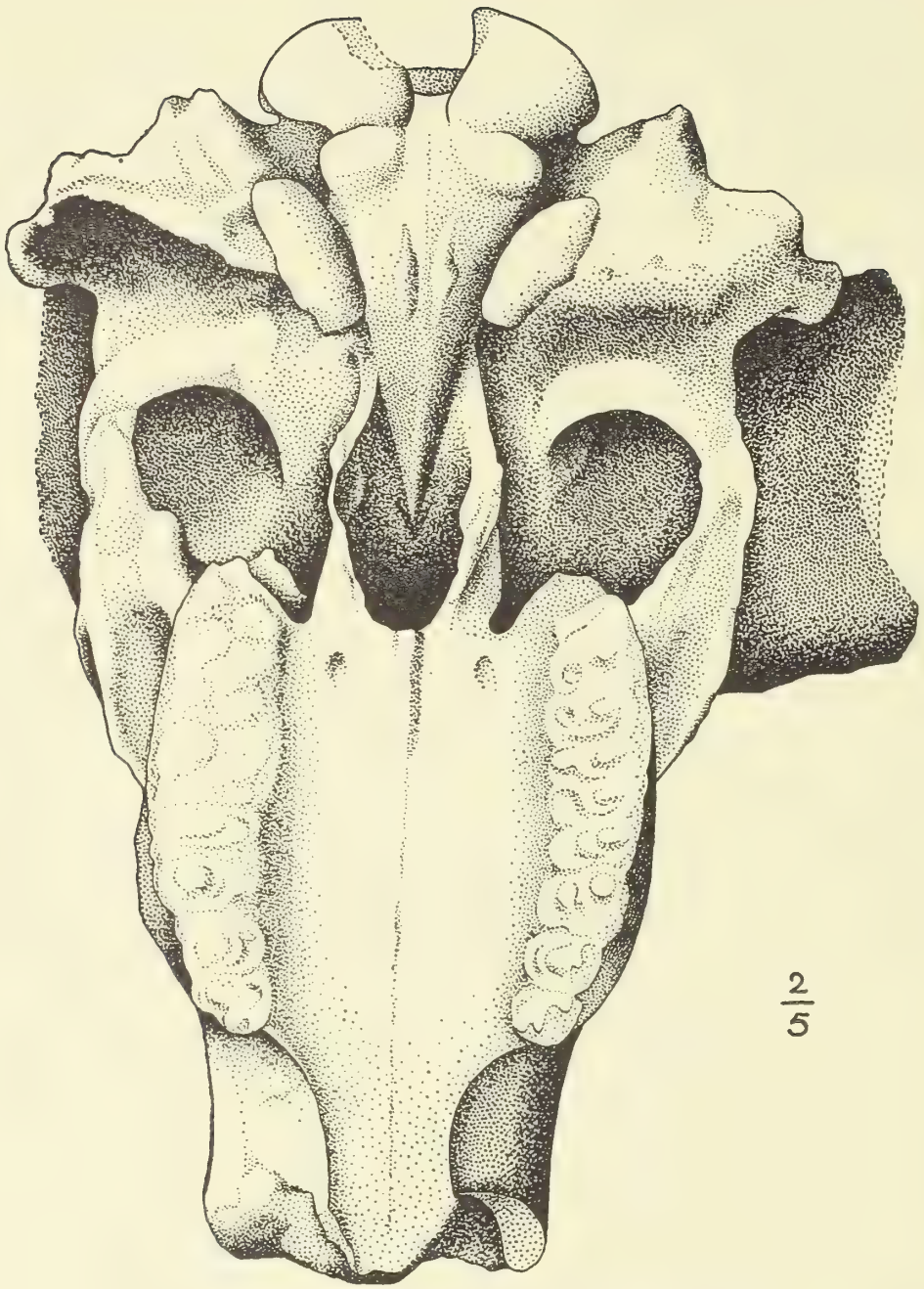

FIG. 6. *Homoioceras singae.* Palatal view of holotype skull, $\times\frac{2}{5}$.

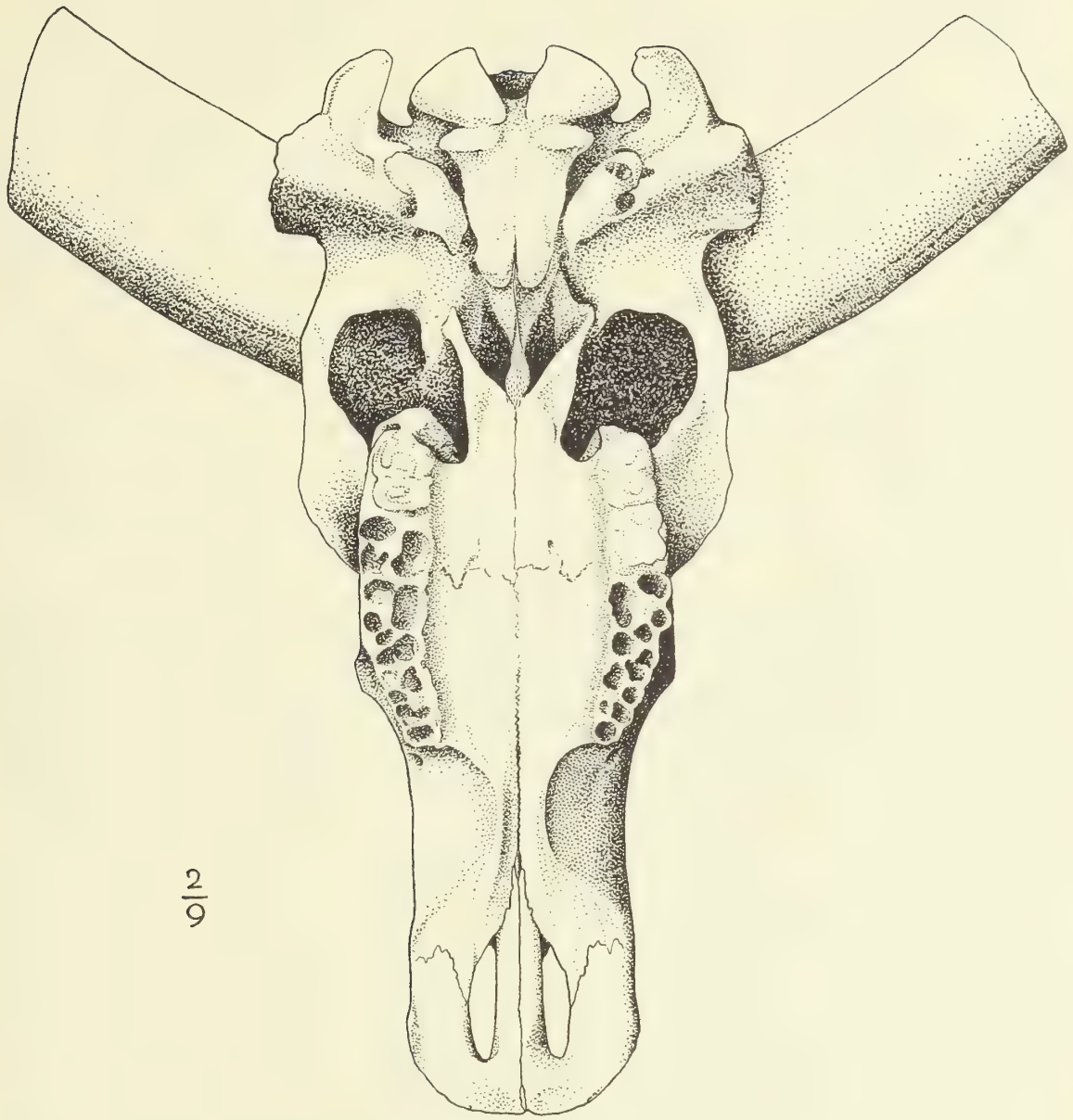

FIG. 7. *Bubalus bubalis.* Recent skull from India. Palatal view, $\times\frac{2}{9}$.

Comparison with other African Fossil Species

Three other fossil species have been referred to above as belonging to the same genus as *H. singae*. The first known fossil buffalo from Africa is "*Bubalus*" *antiquus*, described by Duvernoy (1851) from the upper portion of a skull from Setif in Algeria. It is unfortunate that his holotype is incomplete, since a number of nearly complete skulls have since been discovered. Furthermore it is difficult to be sure that it represents a species identical with other north African examples, such as those figured so carefully by Pomel (1893) and by Thomas (1881). There is a cast of Duvernoy's type in the British Museum (Natural History) and this shows that it is specifically distinct from *H. singae*. Particulars in which it shows differences from the corresponding parts in *H. singae* are that the skull and horns are considerably larger, the section of the horn core is very different (fig. 8a, 8c), and the front of the horn cores in the Algerian specimens are deeply scored by longitudinal grooves. Another important distinction is seen in the basi-occipital which rises at an acute angle in *H. singae*, but mounts at a gentle slope in the far larger *H. antiquus* (holotype). The basi-sphenoid rises at the same angle in both species.

The skulls of *H. antiquus* figured by Thomas (1881) and Pomel (1893) show clearly that they represent a species not identical with, but belonging to the same group of Buffaloes (Syncerina) as *H. singae*. This is seen in the short and broad face, the short palate, which has no contact with the vomer, and in the horn cores which emerge practically at right angles to the skull; also in the short contact between the nasals and the premaxillae.

Remains of *H. antiquus* have been found plentifully in north Africa, chiefly Algeria, and the species persisted through a considerable period of time. It is known from the early Pleistocene (Romer, 1928), Professor Arambourg (1934) claiming it as part of the north African fauna from the Lower Palaeolithic, and as common in the Middle Palaeolithic. That it probably lived on to a still later date is shown by numerous representations preserved on rock surfaces (e.g. Pomel, 1893, pl. 10; see fig. 10). M. Lavauden (1927) has reproduced a spirited engraving of a fight between two bulls taken from a work of M. Flamand which I have not had the opportunity of seeing. There are many other records of specimens and engravings of these buffaloes in north Africa, but they do not concern us here.

A provisional list of fossil mammal remains found at Gau [or Qau], near Asyut, has been published by Professor D. M. S. Watson (1929: 541) from a deposit of uncertain, but probably Pleistocene, age. The species include extinct forms of Giant Cape Buffalo, Hartebeest, and Crocodile. When this collection is studied in detail it will be interesting to learn whether the buffalo is related to the north African species, or to *H. singae*, an inhabitant of the same great river valley.

The mammalian fauna from Kom Ombo, north of Aswan, at Vignard's Sebilian site, has recently been referred to at some length (Bate, 1949) and it is only necessary to mention here that it included a new species of buffalo, "*Bubalus*" *vignardi* (Gaillard, 1934). This is represented by some teeth and by an imperfect horn core, which is figured together with a drawing of its cross-section, neither of which resemble the condition seen in any other known buffalo.

The fine buffalo, *H. nilssoni*, discovered in an Upper Gamblian deposit in Kenya (Nilsson, 1940) and described by Lönnberg (1933), while evidently belonging to the same genus as *H. singae*, is certainly specifically distinct. The drawing of the under-side of the skull, taken from a photograph (fig. 9b) kindly sent by Dr. Nilsson, shows that this is long and narrow compared with that of *H. singae* (fig. 6), and that the bases of the horn cores emerge at a different angle. While the Kenya skull is rather long, both its comparative length, its other proportions, and also the character of the horn cores are quite different from the condition seen in the skull of the Recent *Bubalus* (fig. 7).

A few records may be briefly mentioned, since they may eventually prove to refer to remains of *Homoioceras*. Dr. Hopwood included a large bovine in the Kaiso fauna (1926: 31), and Professor Arambourg (1947) mentions buffalo remains (*Syncerus* aff. *brachyceros*) from Omo, a deposit which is probably of corresponding geological age. The latter author (1947: 521) has published a list of species from the "Villafranchean des plateaux Constaninois" which contains "*Syncerus* aff. *brachyceros* Gray", but I do not know if these remains have yet been described in detail. Dr. L. S. B. Leakey (1946: 41) has recorded, but without description, remains of a bovid of the *Bubalus* type from an Upper Pleistocene deposit at Lake Eyasi, from which portions of human skulls have been obtained. Recently Dietrich (1950) has recorded remains of "*Buffelus* cf. *palaeindicus*" and of *Syncerus caffer* sub-sp. from late Quaternary deposits of the Serengeti plain.

Yet another skull believed to be that of a *Homoioceras* has been found at a depth of 40 feet in the bank of the river Modder, a tributary of the Orange river, South Africa. This specimen was rather inadequately described by Seeley (1891), but the figure he gives certainly suggests that this buffalo should be known as *H. baini*. With the meagre information available it is not possible to make any close comparison with *H. singae*. Remains of this buffalo are not uncommonly found in Pleistocene deposits in South Africa, and Dr. L. H. Wells tells me that these deposits cover a considerable range of time, probably through the Kamasian to the end of the Gamblian. Scott (1907: 256) has described remains of a bovine from Zululand which he named *Bubalus andersoni*.

To conclude the record mention must be made of the discovery some years ago of a buffalo skull in a wadi near Bizerta, Tunisia (Solignac, 1924). This, it is claimed, represents *Bubalus palaeindicus* Falconer, which Pilgrim considered to be a variety of the Recent *B. bubalis* (Pilgrim, 1939: 256), or possibly identical with *B. macroceros* from Assam (Pilgrim, 1947: 277). Unfortunately the under-side of the Bizerta skull is very poorly preserved and, from the figure, the structure of the palate and the surrounding areas cannot be seen. The skull certainly appears to be long and narrow, but apart from this there does not seem to be any character which would exclude it from the section Syncerina. The figure of the hinder portion of the skull, together with the position of the horn cores, suggests a close resemblance to *H. antiquus*. It seems, therefore, that further and more definite information is required before *Bubalus* can be accepted as forming part of the north African fauna.

The above gives a brief survey of our present knowledge of the species of African long-horned fossil buffaloes. There are a number of records of the finding of fragmentary bovine remains in caves, gravels, and other deposits, but these give little

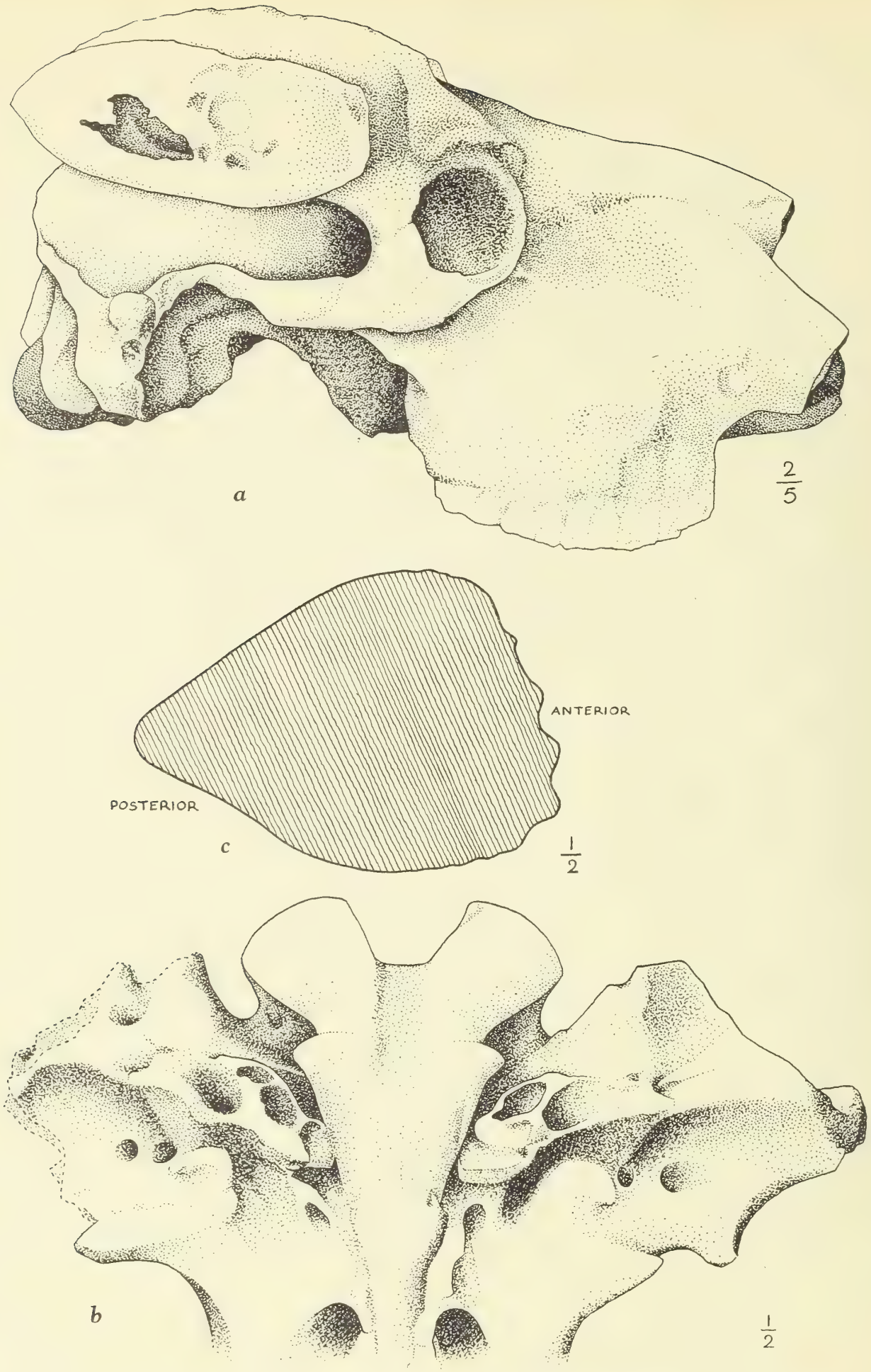

FIG. 8. (a) *Homoioceras singae*. Lateral view of holotype skull, $\times\frac{2}{5}$.
(b) *Homoioceras antiquus* (Duvernoy). Basi-cranium of holotype from Algeria, $\times\frac{1}{2}$.
(c) Section of horn core of *H. antiquus*, holotype, $\times\frac{1}{2}$.

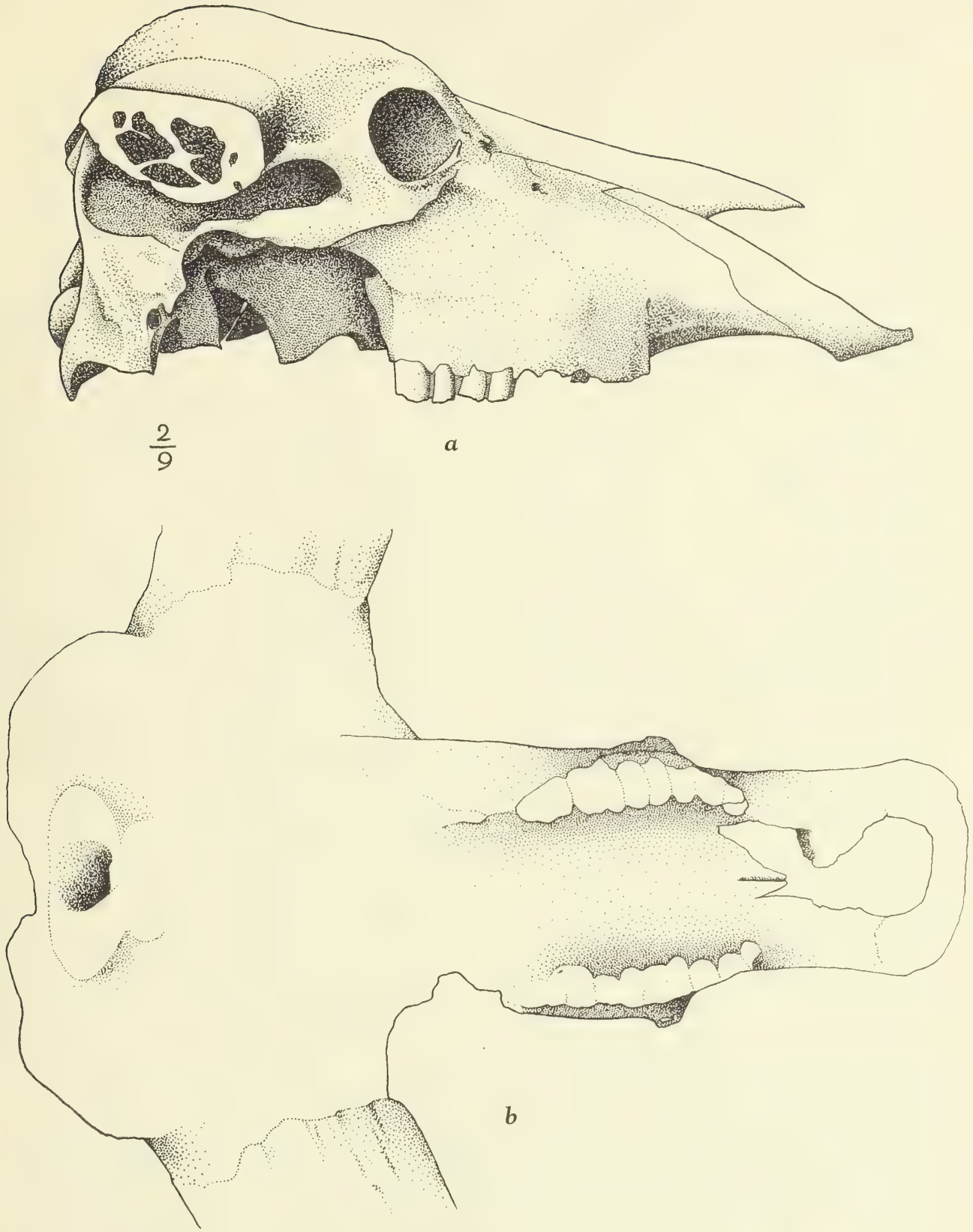

FIG. 9. (a) *Bubalus bubalis*. Lateral view of Recent skull, $\times\frac{2}{9}$.
(b) *Homoioceras nilssoni* (Lönnberg). Sketch of palatal view of holotype skull from Kenya, reduced.

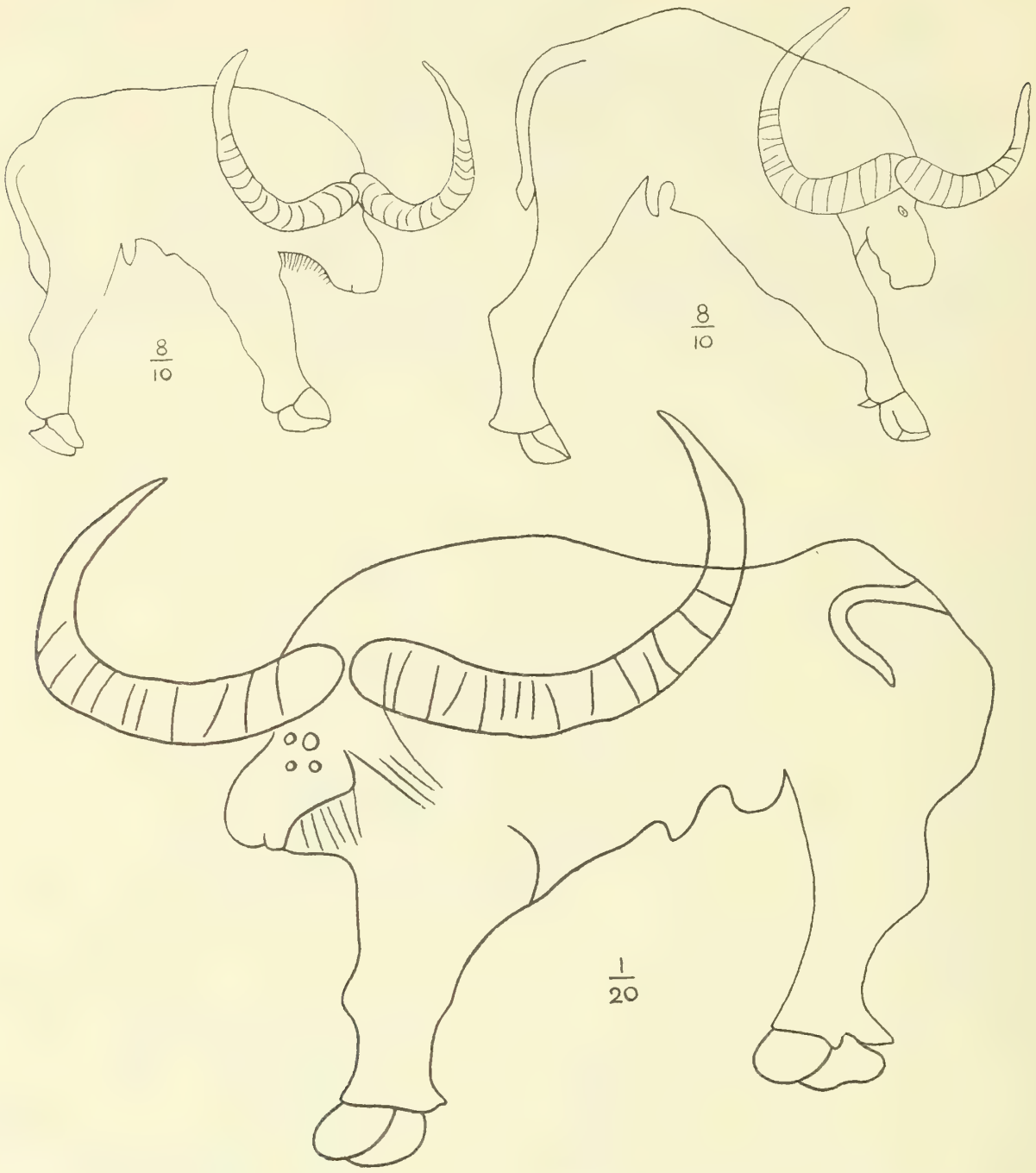

Fig. 10. *Homoioceras* cf. *antiquus* from rock engravings, Algeria. After Pomel, 1893.

information as to the identity of the species. At present it seems to be possible only to put on record some of the differences now known to exist between the several forms of African long-horned buffaloes. Even so this is important, for later when more details are known of their morphology, and of the geological horizons in which they

occur, it may be possible to discover whether these differences are due to evolutionary or ecological causes, or even perhaps in part to riotous development in an unrestricted continental setting.

There is one further important discovery that should be referred to; this is the finding in a cave breccia in the Transvaal of the frontlet and horn cores of a dwarf buffalo about the size of the Congo *S. nanus*. This species described as "*Bos*" *makapaani* by Dr. R. Broom (1937) has horn cores which, from the published figures, appear to be distinct from those of any known fossil or Recent species. They may represent a species of a hitherto unknown lineage of buffalo, or one that may perhaps have some connection with the *S. caffer* group. This discovery confirms the opinion that had already been reached, that the long-horned fossil species, while belonging to the Syncerina section, are quite distinct from, and have not given rise to, the Recent *Syncerus*. It seems not unlikely that both *Homoioceras* and *Syncerus* are entirely African products.

The Systematic Position of the Fossil Long-horned Buffaloes of Africa

The generic distinction between the Asiatic *Bubalus* and the Recent African *Syncerus* has been made abundantly clear, and is now generally accepted. What is not so clear is an understanding of the systematic position of the fossil long-horned African buffaloes. In his great work on the fossil Bovidae of India Dr. Pilgrim (1939: 23) set out a classification of the Bovidae in which he divided the Bovinae into four "generic groups". These are Bubalina, Syncerina, Leptobovina, and Taurina. In a later work (1941: 161) this author says: "The ancestry of *Syncerus*, the modern African buffalo, is still unknown. It belongs to a lineage quite distinct from the Indian buffalo, *Bubalus*, though both are probably descended from a primitive species of *Proamphibos*." [Lower Pliocene.]

It is here claimed that through the study of the almost complete skull of *H. singae*, as well as the descriptions and figures of other African long-horned fossil species it is clearly proved that the African fossil genus *Homoioceras* should, together with the Recent *Syncerus*, be included in the Syncerina.

Pilgrim never himself examined any of the fossil African buffaloes, and merely quotes them as being considered as belonging to the type of Indian buffalo (1939: 255). Lönnberg (1933) in describing *H. nilssoni* says " . . . the African Buffaloes also from the beginning are of Asiatic origin", although he recognized that the Kenya species is closely related to the north African extinct *H. antiquus*. Thus he seems to go back on his own earlier opinion that " there cannot have been any genetic connection between the Asiatic buffaloes and the African ones, at least not between the present time and the Pliocene epoch " (1901: 44–45).

As late as 1947 (p. 437) no less an authority than Professor C. Arambourg wrote "Les Buffles fossiles africains jusqu'ici décrits se rapportent tous au genre asiatique *Bubalus* . . .", although he recognizes that the Recent African buffaloes differ in cranial characters, and probably belong to a line distinct from *Bubalus*.

In view of this persistent misunderstanding regarding the systematic position of the fossil long-horned African buffaloes it seems necessary to go into the matter carefully, so that there may no longer be excuse for perpetuating this misinterpretation

of the facts regarding these fossil species which belong to the same generic group as Recent *Syncerus*.

The genus *Syncerus* was founded by Hodgson (1847) in a paper on ruminants of India, where he briefly states in a footnote (p. 709) that he considers that the Recent African buffaloes are not true buffaloes (*Bubalus*) and suggests the name *Syncerus* in reference to their "united horns". The use of the generic name *Syncerus* was stressed in a short paper by Hollister (1911).

Rütimeyer in his classic work on the Tertiary Bovidae (1878) suggested that, in spite of the great difference in size, the north African fossil *H. antiquus* is most closely related to the Recent *Syncerus brachyceros* from the Lake Chad area. However, as M. Lavauden (1927: 32) has rightly pointed out, *H. antiquus*, which at times attains a gigantic size and has doubtless reached the end of an evolutionary line, cannot be considered as directly ancestral to the Recent African buffaloes as Rütimeyer was inclined to believe.

In 1901 Lönnberg drew up a number of characters, chiefly of the skull, which he considered distinguished the Recent African buffaloes, and *H. antiquus*, from the Asiatic buffaloes. A list of these, together with other characters, was drawn up later by Pilgrim (1939), and the most important may be briefly tabulated thus:

	African		Asiatic
	Recent *Syncerus*	Fossil *Homoioceras*	Recent *Bubalus*
Short broad face	X	X	—
Long narrow face	—	—	X
Short palate and no fusion between vomer and palatines	X	X	—
Fusion of vomer with palatines	—	—	X
Short wide nasals	X	X	—
Premaxillae not, or only slightly, in contact with nasals	X	X	—
Premaxillae with long contact with nasals	—	—	X
Basi-occipital long isosceles triangle in shape	X	X	—
Basi-occipital quadrate and sharply truncated anteriorly	—	—	X

The above characters of the African fossil buffaloes can all be clearly seen in the figures of the skull of *H. singae* (figs. 4, 6, and 8a), and in Pomel's figures of *H. antiquus* (1893). The figure of the under-side of the skull of Recent *Bubalus* (fig. 7) also shows a number of its distinctive elements. There are, of course, other, but less important differences. The above are primitive characters, and regarding these I cannot do better than quote again from Pilgrim (1939: 255): "Since *Proamphibos* and *Hemibos*, the earliest known members of the *Bubalus* lineage, already have the vomer fused with the palatine, and the palate prolonged far behind the teeth, we may deduce that the *Syncerus* [now to include *Homoioceras*] lineage had branched off, at any rate as early as the Pontian, probably in a forested region still unknown. . . ." This forested region may now be located in Africa with some certainty, though definite proof of the presence of ancestral forms is still awaited. Of somewhat uncertain

significance in this direction is the discovery of a single bovine tooth in the Wadi Natrun Pliocene (Andrews, 1902) which has been doubtfully referred to *Parabos* by Pilgrim (1941: 161); this genus is one of the earliest true buffaloes known from the Lower Pliocene of Europe. Professor Arambourg (1947: 511) has since thrown doubt on this identification, and also on the Middle Pliocene age of the deposit, which he considers more likely to be Lower Pleistocene, a suggestion supported by my preliminary study of mammals related to those of the Wadi Natrun. It has also been surmised (Pilgrim, 1941: 161) that the large bovid, *Bularchus arok* from Olduvai (Hopwood, 1936), might have to be included in the African buffalo complex.

It will be seen from the above that the African genera *Homoioceras* and *Syncerus* resemble each other in essential and primitive skull characters; they differ in minor skull characters and in the totally dissimilar shape of the horns. The extreme plasticity seen in the genus *Syncerus*, from the dwarf *S. nanus* to the mighty *S. caffer* (Christy, 1929), suggests that its existence is not of very long standing, but as yet practically nothing is known of its immediate ancestry.

Summary

A description is given of a collection of Pleistocene animal remains from deposits on the Blue Nile, at Singa and Abu Hugar south of Khartoum. This is only the second collection of the kind from the Sudan to be fully described. Added interest arises from its association with a human skull of Pre-Bushman type and with stone artifacts.

The chief character of the fauna as a whole is that it comprises mainly extinct forms, many of the species being quite distinct from those found living in the country at the present day. Proof of this is shown by the presence of a species of Buffalo belonging to an extinct lineage, and of an extinct Porcupine of a type more generalized than Recent forms. Besides this there are specimens not definitely determinable, but almost certainly belonging to extinct genera. These are a ?Sivatherine and an ?Antilopine, bones of which are figured.

The beautifully preserved skull of a Buffalo which is included in the collection has provided not only the opportunity of describing a hitherto unknown species, but it has also enabled a review to be made of the fossil long-horned buffaloes of Africa. These are proved to be entirely distinct from the Asiatic buffalo, *Bubalus*. They are related to the Recent African buffaloes, *Syncerus*, but represent a different group, for which the genus *Homoioceras* has been instituted.

Sufficient details are not as yet available regarding the geology of this rather inscrutable area for it to be possible to suggest a definite dating. (See Andrew *in* Tothill, 1948.) As a general group the animal remains are undoubtedly "Upper Pleistocene", but may not belong to the latest phase of the period. This is indicated, not only by the character of the species, but also by the fact that the bone deposit underlies about fifteen metres of later formations. Changes are continuously and gradually taking place in the composition and status of all faunas, but it has long been known that a big faunal change took place in Europe during the latter part of the Pleistocene period. More recently (Bate, 1937) it has been found that a similar

change occurred in Palestine (between the Lower and Upper Levalloiso-Mousterian levels). A similar faunal break has likewise been recorded in East Africa (between the Upper Kamasian and the Gamblian stages). This seems to suggest that it probably took place in many, if not all, parts of the continent, and presumably in the Sudan at the stage correlated with the forming of the Rift Valleys, see stage marked " ?Earth movements" in Mr. A. J. Arkell's Succession Table (1949*a*).

In the fauna from Singa the Buffalo perhaps, though not necessarily, suggests a time later than the period of ?earth movements and faunal change, whereas the ?Sivatherine would seem to antedate these events. I am at present inclined to favour the earlier date, but a greater knowledge of this fauna and of faunas from other localities alone can solve this fascinating problem. Further there is yet one other point to be remembered, and that is that since most of the specimens were found weathered out of their original layer (Grabham, 1938 and Arkell, 1949*a*), there is the possibility of the presence of representatives of two faunas.

Much gratitude is due to Mr. A. J. Arkell for making this interesting collection available for study, and to the Sudan Government for enabling this to be carried out at the British Museum (Natural History). I also wish to thank Dr. L. R. Cox and Dr. W. E. Swinton for kindly examining the shell and the crocodile skull, and Dr. A. T. Hopwood for helpful talks on African mammals. I would specially record my grateful thanks to the artists, Mr. A. J. E. Terzi and Mr. D. Woodall, for their drawings which help so greatly to illustrate and clarify the facts expressed in the text.

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